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EXAMINER	
BAREFORD, KATHERINE A	

ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 06/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/501,267	ARAM, MEHDI	
	Examiner	Art Unit	
	Katherine A. Bareford	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 May 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) *14-16,18,20-25,29 and 30* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,7-13 and 26-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Claims 6, 17 and 19 are canceled

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

The amendment of May 5, 2006 (in response to the Notice of Non-compliant amendment) has been received and entered. With the amendment claims 6, 17 and 19 have been canceled, claims 14-16, 18, 20, 21-25 and 29 are withdrawn, claims 1-5, 7-13 and 26-~~29~~ 28 are pending for examination, and new claim 30 has been provided drawn to a product piston ring.

Election/Restrictions

1. Newly submitted claim 30 is directed to an invention that is independent or distinct from the invention originally claimed for the following reasons: claim 30 is a product claim that is grouped with the product claims of Group II as originally provided in the Restriction Requirement (see the Restriction Requirement of October 18, 2005 and the interview summary mailed Dec. 9, 2005). Product claim 30, although a product by process claim is grouped with the product claims as no structural limitation other than provided by the product claims is required. See MPEP 2113, which notes that product by process claims are not limited to the manipulations of the recited steps, only the structure implied by the steps.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claim 30 is withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 4, 5, 7-9 and 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over McCormick (US 4024617) in view of Ogden (US 3066042), Japan 2000-017418 (hereinafter '418) and Prasse (US 3617349)..

McCormick teaches a method of applying a wear resistant coating material to a surface of a piston ring. Column 1, lines 35-45, column 3, lines 35-40 and column 4, lines 5-30. The method includes application of the coating material by a thermal spray process, such as plasma spraying or oxy-acetylene flame. Column 4, lines 5-30. The applied coating material is heat treated at an elevated temperature and for a time effective to at least partially diffuse the coating material into the underlying surface by exposing the material to a heating temperature. Column 4, lines 35-60. The temperature range is such that a plasticizing element or constituent of the coating becomes sufficiently plastic to effect diffusion bonding at the interface of the coating and surface. Column 4, lines 55-60.

Claim 4: the heating is provided by induction. Column 4, lines 35-60.

Claim 9: the coating material can be a powder (pulverulent). Column 5, lines 29-35.

Claim 12: the coating material can contain alumina (aluminum oxide). Column 6, lines 60-65.

Claim 13: the coating material can be a cermet. Column 5, lines 29-35.

McCormick teaches all the features of these claims except (1) that multiple layers are put down with a heating diffusion treatment after each layer is applied, (2) the porosity of the resulting piston ring and its layers, (3) the even porosity and open pores (claim 5, 7), (4) the layer thickness (claim 8), (5) the heat treatment resulting in necks (claim 11).

However, Ogden teaches applying layers by spraying molten metal and subsequent heat treatment to diffuse the applied coating layer. Column 2, lines 10-60. Multiple thin layers are applied and respective following heat treatments are performed until the desired thickness of the coating is achieved. Column 2, lines 10-60. For example, each layer can be 0.003 inches (0.076 mm) thick and the operation repeated four times until a thickness of 0.012 inches results. Column 2, lines 50-60. Ogden teaches that this method gives better results then to spray a single thick coating and heat treating, by improving diffusion and providing a stronger mechanical and metallurgical bond. Column 2, lines 40-45.

'418 teaches to apply an antifriction wear resistant coating to a bearing base material. See the abstract and paragraph [0008]. A metal layer is applied to a substrate

bearing face of the bearing base material by a thermal spraying method. See the abstract and paragraph [0009]. Then a diffusion heat treatment is applied at a temperature equal to or below the melting point. See the abstract. This diffuses the coating into the substrate material. See the abstract. Prior to the heat treatment the coating has a porosity of 20 percent or less. See the abstract and paragraphs [0009]—[0010]. After the heat treatment the coating is hardened and has a porosity that has decreased to less than 10 percent. See the abstract and paragraph [0010]. However, porosity still remains after the heat treatment. See paragraphs [0052]—[0053]. The final porosity can vary depending on the conditions. See paragraphs [0049] and [0053].

Prasse teaches coating piston rings with a hard porous metal or alloy. Column 1, lines 45-55. Prasse teaches that the coating can be by thermal spraying, such as plasma spraying. Column 6, lines 10-50. The spray applied coating desirably has an open porosity of 7-20 percent to allow inclusion of an anti-friction agent in the pores. Column 2, lines 55-70.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify McCormick to apply multiple layers of coating with a heating diffusion treatment after each layer is applied as suggested by Ogden with an expectation of desirable diffusion and bonding results, because McCormick teaches applying a coating to a piston ring and performing diffusion heat treatment after coating, and Ogden teaches that when applying a coating and performing diffusion heat treatment after coating, it is desirable to apply the coating as multiple layers with

heating diffusion treatment after each layer is applied in order to provide better diffusion and bonding results. As to the temperature used, it would vary based on the coating material used, but McCormick suggests to perform routine experimentation to optimize the temperature by teaching to use a temperature range such that a plasticizing element or constituent of the coating becomes sufficiently plastic to effect diffusion bonding at the interface of the coating and surface. It further would have been obvious to one of ordinary skill in the art to modify McCormick in view of Ogden to optimize the porosity to be provided for the piston ring through the diffusion treatment to, for example, an open porosity 7 percent as suggested by '418 and Prasse so as to provide a desirable coated piston ring, because McCormick in view of Ogden teach to perform diffusion heat treatment, with Ogden indicating that such treatment reduces porosity, and '418 teaches that when performing diffusion heat treatments on layers used as antifriction bearing surfaces, diffusion heat treatment can be used to reduce the porosity of thermal sprayed coatings to less than 10 percent, for example, to 1.5 percent and Prasse teaches that when thermal spray coating a piston ring with a coating, a desirable final porosity is an open porosity of seven percent. As to the evenly distributed porosity, this would be an inherent result of applying the thin layers and have the porosity reducing treatment on each layer. As to the layer thickness, Odgen teaches that a desirable individual layer thickness is 0.003 in (0.076 mm). As to the heat treatment resulting in necks, it is the Examiner's position that this would be an inherent result of performing the suggested diffusion heat treatment.

4. Claims 2, 3, 10 and 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over McCormick in view of Ogden, '418 and Prasse as applied to claims 1, 4, 5, 7-9 and 11-13 above, and further in view of Rastegar et al (US 5713129).

McCormick in view of Ogden, '418 and Prasse teach all the features of these claims except (1) the relative movement between thermal spray device and heat treatment device and the piston ring (claim 2), (2) the rotation about the axis (claim 3, 26), (3) the wire like form of the coating (claim 10).

However, Rastegar teaches applying a thermal spray coating to a piston ring. Column 2, lines 45-55. The method includes rotating a plurality of piston rings about a central axis and spraying a molten material on the outer surface of the piston rings. Figure 1, column 4, lines 5-30 and column 8, lines 25-30. The thermal spray device is thus positioned so that there is relative movement between thermal spray device and the rotating piston rings. Figure 1, column 4, lines 5-30 and column 8, lines 25-30. The thermal spray device can be a high velocity oxy fuel gun (a form of flame spraying). Column 4, lines 5-30. The spray device can be used with either stock (wire) or powder coatings. Column 4, lines 5-30. During the spraying process the spraying apparatus traverses parallel to the longitudinal axis of the rotating piston rings. Column 8, lines 25-30. Multiple passes (that is, layer applications) are used to provide the final thickness of the coating. Column 8, lines 25-30. Rastegar further teaches that a cooling

device 18 can be placed facing the piston rings such that cooling air can be applied to the rings after coating. Figure 1, column 4,lines 30-40 and column 8, lines 30-40.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify McCormick in view of Ogden, '418 and Prasse to provide the relative movement between the piston ring and thermal spray device/heat treatment device with rotation of the piston ring about it's axis and the use of powder or wire coating material as suggested by Rastegar in order to provide a desirable and efficient application method, because McCormick in view of Ogden, '418 and Prasse teach thermal spray application of a coating on piston rings, and Rastegar teaches that a desirable method of thermal spraying piston rings involves using powder or wire coating material fed to a thermal spray device which moves relative to the piston ring while the piston ring is rotated about its axis so that multiple layers of coating material are applied until the final coating thickness is reached. It further would have been obvious to place the heat treatment device relative to the piston rings in a similar fashion to the thermal spray device for immediate treatment as each layer is formed in order to provide for efficient coating, because Rastegar shows that it is known to place another treatment device for post treatment of the coating (in that case, a cooling device to be used after all coating is done), and Ogden teaches the desire to heat treat each layer before formation of the next one.

Response to Arguments

5. Applicant's arguments (filed with the amendment of March 9, 2006) with respect to claims 1-5, 7-13 and 26-28 have been considered but are moot in view of the new ground(s) of rejection.

Applicant has argued that Odgen teaches to eliminate pores and would not suggest providing the resulting porosity of between 1 and 15 vol. %. The Examiner has provided Japan 2000-01418 ('418) to indicate that that when applying antifriction coatings on bearing surfaces (and piston rings would be a known form of such a surface) by thermal spraying, it is known to perform diffusion heat treatments on such coatings to reduce but not eliminate porosity. The provided porosity can be in the range of 1 to 10 %, which is in the range taught to be desirable by Prasse. This combination of references clarifies that when coating bearing surfaces such as piston rings by thermal spraying and then diffusion heat treating, one of ordinary skill in the art would control the heat treatment diffusion conditions to provide desirable porosity in the range of 1 to 10%. This would occur even if multiple layers were provided as suggested by Ogden, because while Odgen eliminates porosity in his application, his application is not to a bearing surface such as a piston ring. The benefits that Odgen discusses of using multiple layers, including the improved diffusion and stronger mechanical and metallurgical bond would still be present.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine A. Bareford whose telephone number is (571) 272-1413. The examiner can normally be reached on M-F(6:00-3:30) with the First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone numbers for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and for After Final communications.

Other inquiries can be directed to the Tech Center 1700 telephone number at (571) 272-1700.

Furthermore, information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KATHERINE BAREFORD
PRIMARY EXAMINER